VISVESVARAYA TECHNOLOGICAL UNIVERSITY

MINI PROJECT REPORT ON

"RFID AND KEYPAD BASED DOOR LOCK SYSTEM WITH MOBILE NOTIFICATION USING ARDUINO "

SUBMITTED BY:

PAVAN R(1NH18EE068)

VISHAL GUPTA (1NH18EE755)

VIVEK RANJAN (1NH18EE069)

MOHAMMED FARHAN SHARIF (1NH18EE729)

Under the guidance of

MS. ROOPA.C

Dept. of EEE, NHCE, Bengaluru.

NEW HORIZON COLLEGE OF ENGINEERING

(ISO-9001:2000 certified, accredited by NAAC 'A', Autonomous college permanently affiliated to VTU) Outer Ring Road, near Marathalli, 560103, Bengaluru

NEW HORIZON
COLLEGE OF ENGINEERING
New Horizon Knowledge Park, Ring Road, Marathalli
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

BONAFIDE CERTIFICATE

Certified that the mini-project entitled *"RFID AND KEYPAD BASED DOOR LOCK SYSTEM WITH MOBILE NOTIFICATION USING ARDUINO"* is carried out by PAVAN R bearing USN:1NH18EE068 and VIVEK RANJAN bearing USN: 1NH18EE069 and VISHAL GUPTA bearing USN:1NH18EE755 and FARHAN bearing USN: 1NH18EE729 bonafide students of NHCE, Bengaluru, in partial fulfilment for the award of Bachelor of Engineering in Electrical and Electronics of the Visvesvaraya Technological University, Belagavi during the year 2020-2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the department library. The mini project report has been approved as it satisfies the academic requirements in respect of the Mini-project work prescribed for the said degree.

Guide Name **Dr.MAHESH M**

MS Roopa.C **HoD**

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MOHAMMED FARHAN SHARIF(1NH18EE729)

PAVAN R (1NH18EE068)

VIVEK RANJAN(1NH18EE069)

VISHAL GUPTA (1NH18EE755)

TABLE OF CONTENTS

5

ABSTRACT

There has been huge demand for security system that must be dependable and very fast respond for core industries and companies. RFID (Radio Frequency Identification) is one of the smooth and fast Sensor for identifying material or any object. In the long time before the barcode's are likely more preferable as compared to these RFID tags because of their cost but in todays world RFID is more easy or convenient to use for security purposes.

Research has proved some basic changes which reduces its programming a lot shorter and easier is because by replacing microcontroller with Arduino UNO or MEGA. Arduino has made each small and large circuit easier to implement or to get the perfect and desired output.

RFID, Radio Frequency Identification is an inexpensive technology or component which can be used or implemented in several application places like security system, people tracking, access control application etc.

The main objective of this project is to make a RFID and Keypad based security door lock with messaging system which can deploy in secure zone where only authentic or owner of the room can enter inside the room. We implemented a project where when a person enters inside room he has to scan the RFID tag and then he needs to put the correct password in the keypad to open the door and if the card does not get matched with original one the owner of the room will get a alert message for unlocking the room using wrong tag.

The advantage of using passive RFID is that it functions without any battery and it has a specific key value or password of 8 bit that can be used during security purposes and these tags are lighter and so less expensive.

CHAPTER 1

INTRODUCTION

The project that we will be working on is an RFID door lock system with mobile messaging system that will help any owner of any private room of any industry to keep his important thing safe which is there inside the room. The goal of this project is to create a more convenient way to unlock your door than the traditional key. In the place of Keys the RFID tags will be used to open the door in automatic way. No need to keep the old keys to open the lock. Anyhow the improvements of this RFID door lock must outweigh the complications of implementation. The list of customer needs is the fundamental goal in our mind.

The design consists of two main components. The first component is the actual door lock that has to be set near the door frame. This will be controlled by motor which can be programed using Arduino to open the door. The second component or the second working is if door does not open or if the password or the scanned tag is wrong it will send us an alert notification and this part can be done using GSM module which is programed using Arduino and embedded c.

Chapter 3 goes over the requirements, specifications and hardware or software description determined for the RFID door lock system. The requirements are inspired by personal interest and by contribution of each group members. The specifications and components are designed in order to meet with project requirements. These are bought before the final design of this door lock system and it is created so the requirements and specifications may not exactly meet the final requirement. However, the final product is still designed with these ideas in mind.

In the (Chapter 4), the design of the final product is shown and explained. The output screenshot is shown there. This chapter also documents the tests and complications confronted throughout the design. The design is split into some modules which were tackled individually until finally bringing the whole product together. The necessity of each chapter or module is explained properly.

RFID has a wide and vast range of high quality uses throughout industry, ecommerce, education and the public sector more widely. Moreover, we are using Arduino UNO to implement this project.

Arduino UNO helps us more in the side of programming, it has mainly some digital and some analog i/o pins which pins are of some using reason. We have implemented the program using embedded c with Arduino IDE which is a open source software.

CHAPTER 2 **OBJECTIVE:**

The main objective of this project is to make a RFID and Keypad based security door lock with messaging system which can deploy in secure zone where only authentic or owner of the room can enter inside the room. We implemented a project where when a person enters inside room

he has to scan the RFID tag and then he needs to put the correct password in the keypad to open the door and if the card does not get matched with original one, the owner of the room will get a alert message for unlocking the room using wrong tag. Even if the password does not match with correct password then also it will send a notification in users mobile saying that he puts a wrong password to open the door. The user of the door lock system can directly halt or close the door by typing ‘close’ in the message prompt keypad.

CHAPTER 3

LITERATURE SURVEY

Tushar G. Gaikai Soham N. Zadokar Rajendra S. Bhandari Sagar S. RFID DOOR Lock system and Arduino "

The proposed system is done by using an Arduino UNO RFID Sensor, Servomotor and LCD Display. The main objective of this project is to make a RFID and Keypad based door lock using mobile notification. Firstly, the program should be uploaded into the Arduino board which is written in the Arduino software.

M.Anil Kumar, Dr. S. A. K. Jilani, Mr. U. Sreenivasulu Mr. S. Javeed Hussain "GSM Module based messaging System using Arduino and Mobile App"

This will tell how to send SMS from mobile to GSM module and GSM module to mobile phone. It gives a brief description about the pin connection with GSM module and Arduino UNO. How to give command in the serial monitor in Arduino IDE software to send messages is properly explained here.

Internet of Things with ESP8266 by Marco Schwartz

It tells about connection like how Node Mcu can be connected to cloud. Program for connection is not described here.

RFID for Libraries: A Practical Guide By M. Paul Pandian

CHAPTER 4

PROJECT DESCRIPTION

❖ HARDWARE DESCRIPTION

The hardware components you are going to require for RFID and Keypad based door lock system with mobile notification and alert system using Arduino are as follows:

1. Arduino Uno or any other Arduino
2. I2C LCD
3. RFID Tags and RFID SENSOR
4. SIM900 GSM module
5. 5V, 2A power adapter
6. SG90 Servo motor
7. 4X4 Keypad or 4X3 Keypad
8. 3 X LED's (Red, Green, Blue)
9. 3 X 220 Ohm resistors
10. Buzzer
11. Power Source

EXPLANATION ABOUT THE HARDWARE COMPONENTS

• ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains each and everything what a microcontroller is needed. Just connect this board to a computer with a Arduino Uno supported USB cable or otherwise it can get power through power source. But only 5v power supply is compatible with it because it can not take higher voltage as it operates under 5V.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USBto-serial converter.

"Uno" means one or 1 in Italian and is named as like this because to the upcoming release of Arduino 1.0. The Arduino Uno or the Arduino 1.0 will be the two reference versions of Arduino. The Uno is the latest version of USB Arduino boards but for large circuit or many different circuits are getting connected that Arduino Mega will be a better choice as the Arduino Uno board can't control big circuits.

FEATURES OF ARDUINO UNO:

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7 – 12V
Input Voltage (limits)	6 – 20V
Digital I/O Pins	14
Flash Memory	32 KB (ATmega328)
SRAM	2 KB (ATmega328)
Clock Speed	16 MHz

TABLE 1: ARDUINO UNO FEATURES

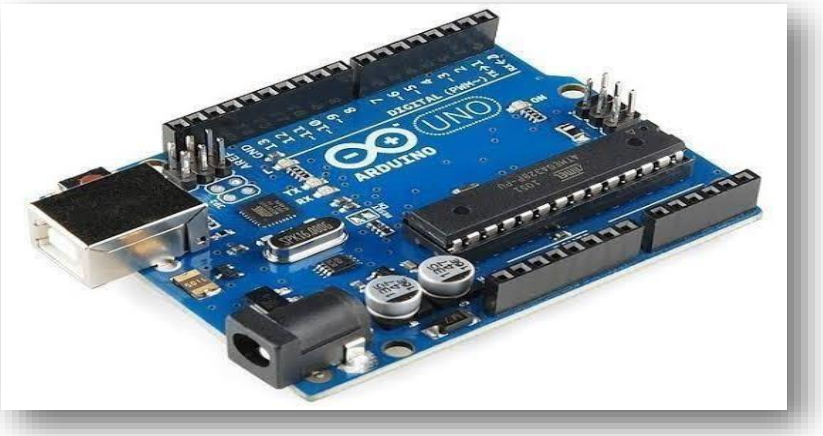

FIGURE 1: ARDUINO UNO BOARD

❖ I2C LCD DISPLAY

For our project RFID and Keypad based door lock we are using I2C LCD as an important component. We are not using direct LCD display board because of more pin connection. But if we use the I2C with the LCD display then the connection of LCD display with the Arduino Uno board will be much easier. So we are just integrating I2C with the LCD display.

LCDs are useful for creating standalone projects. This LCD Display utilizes an I2C interface, which means that fewer pins are necessary to use this product than would be needed with a regular 16x2 LCD Display (just four connections, VCC, GND, SDA & SCL are required). And it is backlit. I2C address is usually decimal 39, hex 0x27. These devices can sometimes be found at decimal 63, 0x3F. It is very easy to find an I2C address on Arduino by using i2c_scanner.

RFID READER

RFID stands for Radio Frequency Identification. It uses radio frequency waves to identify any object or people automatically. RFID is an automated data-capture technology that can be used to electronically identify, track, and store information contained on a tag. A radio frequency reader will scan the RFID tag and it sends the data to the database and if the sent data gets matched with the data present in database, it verifies something which can be programed with the scanned tag.

RFIDs are not just "electronic tags" or "electronic barcodes". When linked to databases and communications networks, such as the Internet, this technology provides a very powerful way of delivering new services and applications, in potentially any environment

RFID TAGS

An RFID tag contains of a chip and antenna. A chip can store the unique s number or any other secure information based on the tag's type of memory, which may be read-only, read-write, or write-once read-many. The antenna that is attached to the microchip, sends information from the chip to the reader. Basically a larger antenna indicates a large read-write range. Each RFID tags has its own specific key value which can be used for security purposes. When the key value of the RFID tag gets matched with actual one then the door lock opens.

CLASSIFICATION OF RFID TAGS

- ➢ Passive tags
- ➢ Active tags
- ➢ Semi passive tags
- ➢ Read only tags
- ➢ Read write tags
- ➢ Write once read many times tags

FIGURE 5: RFID TAGS

SIM900 GSM MODULE

This is a GSM/GPRS-compatible Quad-band cell phone, which works on a frequency of 850/900/1800/1900MHz and which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMSs. Externally, it looks like a big package (0.94 inches x 0.94 inches x 0.12 inches) with Lshaped contacts on four sides so that they can be soldered both on the side and at the bottom. Internally, the module is managed by an AMR926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself.

The processor is also in charge of a SIM card (3 or 1,8 V) which needs to be attached to the outer wall of the module.

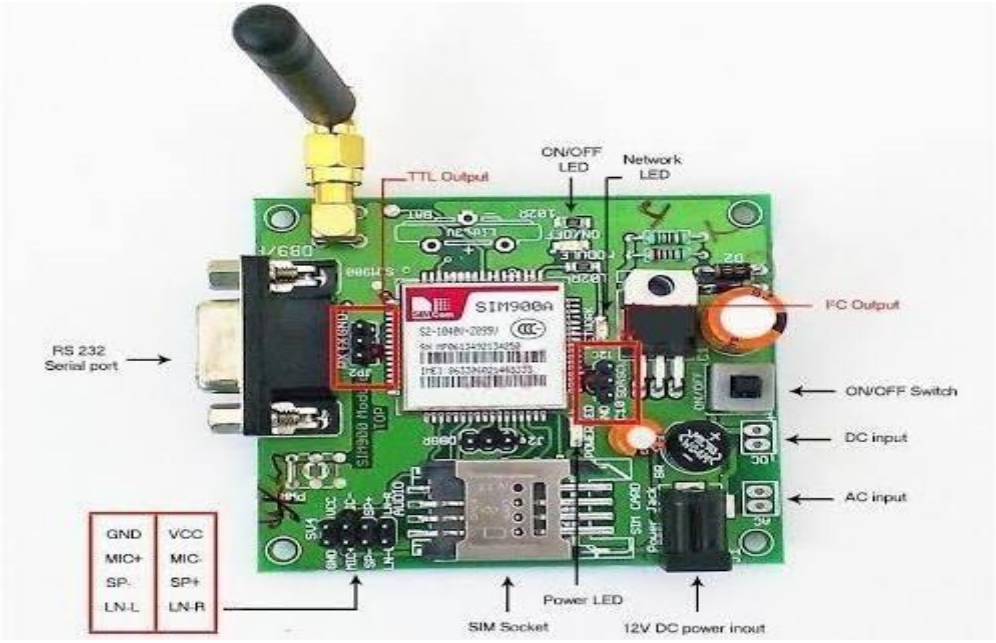

FIGURE 6: GSM MODULE

SOFTWARE DESCRIPTION

We are using Arduino IDE as the main software to program the working mode for our project. Arduino IDE is best for writing Embedded C program and using embedded c are doing our complete project.

ARDUINO IDE:

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.[2]

The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *AVR dude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

CHAPTER 5

PROPOSED METHODOLOGY

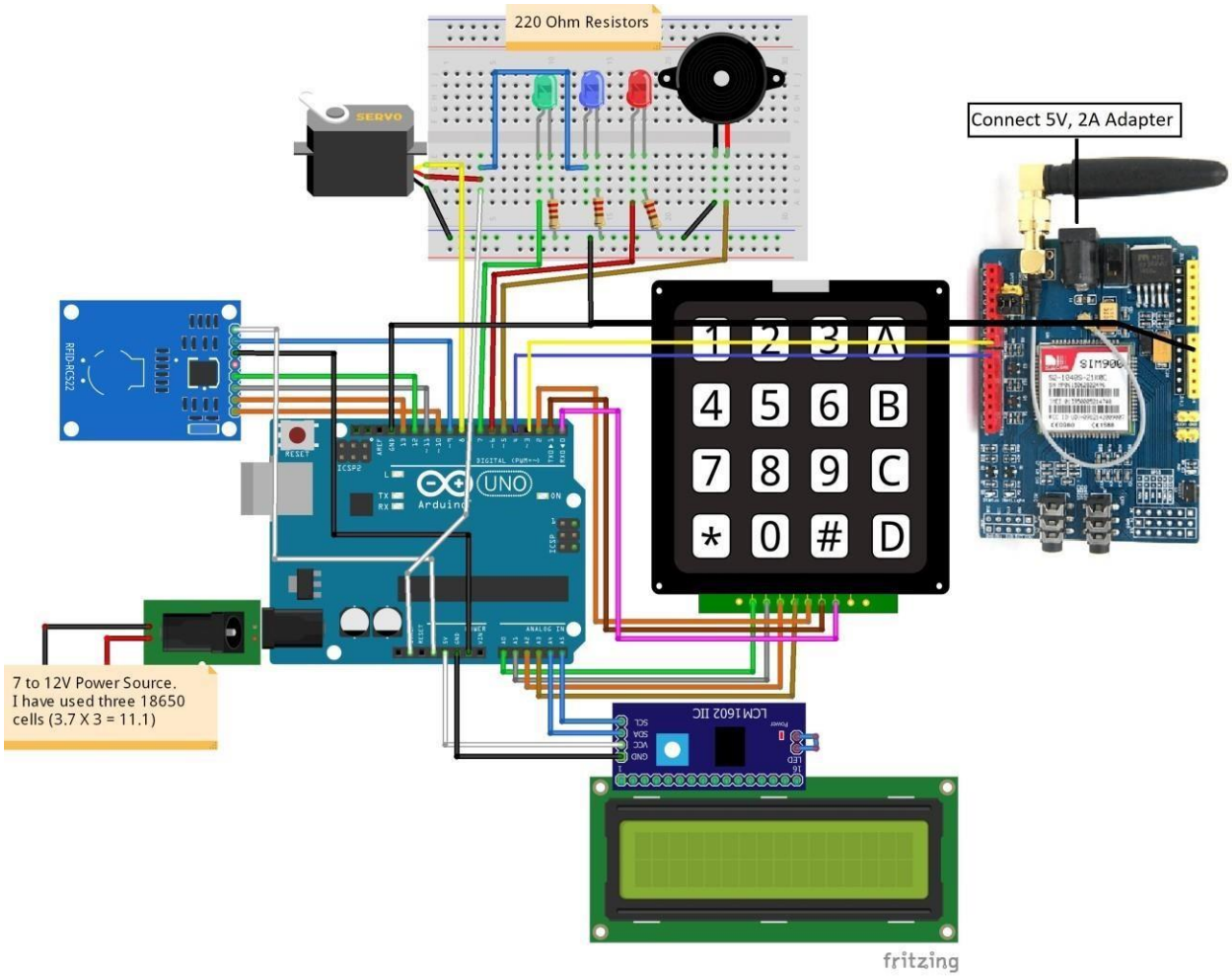

FIGURE 7: CIRCUIT CONNECTION

METHODOLOGY:

This can be divided into five steps. These are:

1.RFID INTERFACING WITH ARDUINO:

The RFID reader communicates with Arduino Uno board through different protocol and these different Arduino has different type SPI pins. The connections of RFID with the Arduino Uno board are shown in the Figure 6. The RFID reader we are going to use is MFRC522 reader module and it communicates with Arduino Uno board by SPI protocol. It operates under 13.5MHZ frequency. The tags we are using that can perform arithmetic operations. The connection of RFID reader is given below:

2.I2C LCD INTERFACING WITH ARDUINO

The I2C LCD display board communicates with Arduino Uno board through I2C protocol. Different I2C pins have different type of I2C pins. The I2C pins in the Arduino Uno board are A4 and A5. The below table gives the connection of Arduino with I2C LCD:

I2C LCD	Arduino Uno
SCL	A5/SCL
SDA	A4/SDA
GND	GND
VCC	5V

TABLE 2: I2C LCD PIN CONNECTION

3. INTERFACING KEYPAD WITH ARDUINO

Next, we are going to connect the keypad with Arduino Uno board. Generally, the 4*4 keypad has 8 connections but we do not the very last column of the keypad board as we are using only numbers to set the password in the program. We also can use 4*3 keypad instead of 4*4 keypad. The pin connections are given below:

4*4 Keypad	Arduino
1ST pin	A0
2nd pin	A1
3rd pin	A2
4th pin	A3
5th pin	D2
6th pin	D1
7th pin	D0

TABLE 3: KEYPAD CONNECTION

4. SERVO MOTOR INTERFACE WITH ARDUINO UNO

The servo motors will remain in the position they were moved and if the external force is applied to it to move it in some other direction, then it will resist against it and it will move in the previous direction. The servo motors will not remain in this direction forever, the commands should repeat to keep them in same position.

- Yellow wire is the signal wire and it should be connected to digital pin of Arduino. ○ The brown wire is the ground pin and it has to be connected with the ground of Arduino.
- Red wire is the Power source wire and it will be connected with 5V pin of Arduino.

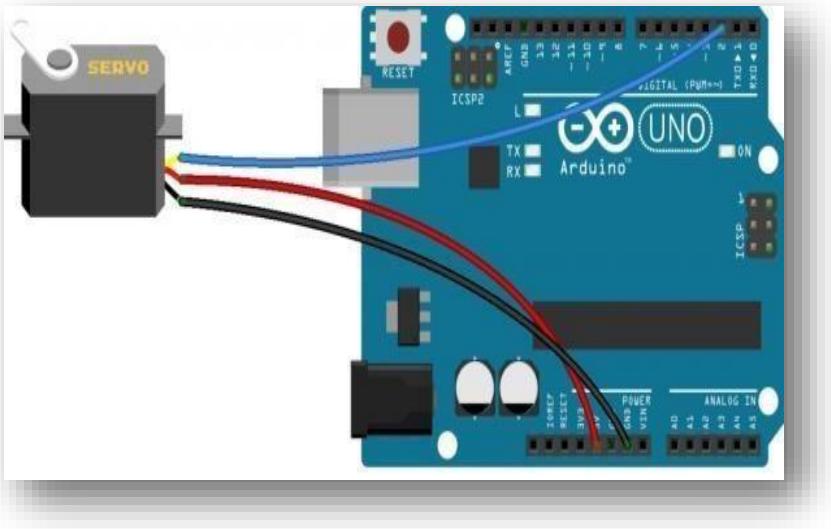

FIGURE 9: INTERFACING SERVO MOTOR WITH ARDUION

5. INTERFACING ARDUINO WITH GSM MODULE (SIM 900A)

Once the sim900 module is powered the light will light up, on pressing the power key the Net light should start blinking. If you are success making a call from your phone to the GSM module then it's fine that the Module is working. The below table gives pin connection between Sim900 and Arduino.

Arduino	SIM900
D3	D7
D4	D8
GND	GND

TABLE 4: GSM MODULE PIN CONNECTION WITH ARDUINO

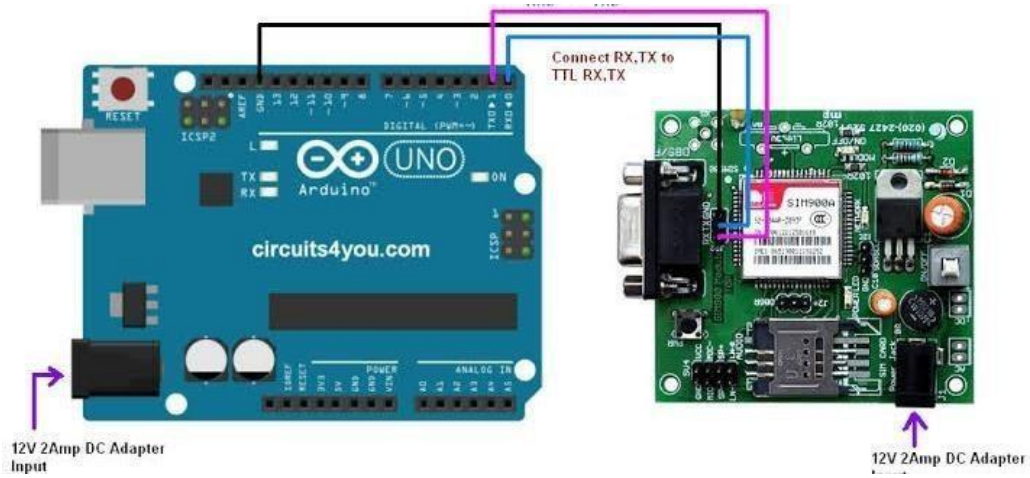

FIGURE 10: ARDUINO WITH GSM MODULE SIM 900A

CHAPTER 6

WORKING:

The project that we will be working on is an RFID door lock system with mobile messaging system that will help any owner of any private room of any industry to keep his important thing safe which is there inside the room. The goal of this project is to create a more convenient way to unlock your door than the traditional key. In the place of Keys the RFID tags will be used to open the door in automatic way. No need to keep the old keys to open the lock. Anyhow the improvements of this RFID door lock must outweigh the complications of implementation. The list of customer needs is the fundamental goal in our mind.

This door lock has some basic working features. These are:

- On scanning the wrong tag or entering a wrong Password, it will send the user an alert notification message. It is done through GSM module and Arduino.
- On scanning the right tag and by entering the right password the motor starts rotating at 180 degree, the door will be opened and it sends us a notification message that door has opened.
- We can halt the system by typing “close” and sending it Arduino and then it will go back to normal mode when you have to send “open” message to open the door back again. During the halt time, it won’t scan any tags and it will look only for messages to open the door back.
- We can also open the door by messaging to the Arduino board.
- Even on scanning the wrong tag or entering wrong password, the buzzer will start beeping and it notifies the owner of the room.

CHAPTER 7

RESULT AND DISCUSSION

In this study, we have implemented a RFID and Keypad based door lock system with Mobile notification using passive RFID. A centralized system is being deployed for controlling and opening operations. The door locking system functions in real time as when the user put the tag in contact with the reader, the motor starts rotating and the door opens. We utilize RFID technology to provide solution for secure access of a door or any private room of any owner.

CHAPTER 8

FUTURE SCOPE

It depends upon how one can enhance the use of this project. But for us this project is practical for future uses such as Smart cart can be interfaced with wireless technologies to make it completely portable in the near future. A lesser cost RFID reader can be manufactured and used which can scan multiple tags simultaneously for faster processing. RFID based security system or door lock can be used in huge amount in the coming future. The RFID scanner can be used in different fields i.e.:

1. In malls for generating bills without standing in a queue.

2. Gaming zone

3. Environmental problems to control and make nature friendly.

4. Uses in ATM machines

CHAPTER 9

REFERENCES

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[2] Zhang, L., “An Improved Approach to Security and Privacy of RFID application System”, Wireless Communications, Networking and Mobile Computing. International Conference. pp 1195- 1198, 2005.

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[5] R. Weinstein, "RFID: a technical overview and its application to the enterprise," IT Professional, vol. 7, pp. 27 - 33, May-June 2005.

[6] RFID for Libraries: A Practical Guide By M. Paul Pandian.

[7] Internet of Things with ESP8266 by Marco Schwartz

APPENDIX

PROGRAM TO RUN THE MODEL

```
// Include required libraries
#include <MFRC522.h>
#include <LiquidCrystal_I2C.h>
#include <Keypad.h>
#include <SoftwareSerial.h>
#include <Servo.h>  #include <SPI.h>

// Create instances
SoftwareSerial SIM900(3, 4); // SoftwareSerial SIM900(Rx, Tx)
MFRC522 mfrc522(10, 9); // MFRC522 mfrc522(SS_PIN, RST_PIN)  LiquidCrystal_I2C lcd(0x27, 16, 2);  Servo sg90;

// Initialize Pins for led's, servo and buzzer
// Blue LED is connected to 5V
constexpr uint8_t greenLed = 7;
constexpr uint8_t redLed = 6;
constexpr uint8_t servoPin = 8;  constexpr uint8_t buzzerPin = 5;

char initial_password[4] = {'1', '2', '3', '4'}; // Variable to store initial password
String tagUID = "29 B9 ED 23"; // String to store UID of tag. Change it with your tag's UID
char password[4]; // Variable to store users password
boolean RFIDMode = true; // boolean to change modes
boolean NormalMode = true; // boolean to change modes
char key_pressed = 0; // Variable to store incoming keys  uint8_t i = 0; // Variable used for counter

// defining how many rows and columns our keypad have  
const byte rows = 4;  const byte columns = 4;

// Keypad pin map
char hexaKeys[rows][columns] = {
{'1', '2', '3', 'A'},
{'4', '5', '6', 'B'},
{'7', '8', '9', 'C'},
{'*', '0', '#', 'D'}
};

// Initializing pins for keypad
byte row_pins[rows] = {A0, A1, A2, A3};  byte column_pins[columns] = {2, 1, 0};

// Create instance for keypad
Keypad keypad_key = Keypad( makeKeymap(hexaKeys), row_pins, column_pins, rows, columns);

void setup() {
// Arduino Pin configuration
```

```
pinMode(buzzerPin, OUTPUT);
pinMode(redLed, OUTPUT);  pinMode(greenLed, OUTPUT);

sg90.attach(servoPin); //Declare pin 8 for servo  sg90.write(0);
// Set initial position at 0 degrees

lcd.begin(); // LCD screen
lcd.backlight();
SPI.begin(); // Init SPI bus  mfrc522.PCD_Init(); // Init MFRC522

// Arduino communicates with SIM900 GSM shield at a baud rate of 19200
// Make sure that corresponds to the baud rate of your module  SIM900.begin(19200);

// AT command to set SIM900 to SMS mode
SIM900.print("AT+CMGF=1\r");
delay(100);
// Set module to send SMS data to serial out upon receipt
SIM900.print("AT+CNMI=2,2,0,0,0\r");  delay(100);

lcd.clear(); // Clear LCD screen
}

void loop() {
if (NormalMode == false) {
// Function to receive message
receive_message();
}

else if (NormalMode == true) {
// System will first look for mode
if (RFIDMode == true) {
// Function to receive message  receive_message();

lcd.setCursor(0, 0);
lcd.print(" Door Lock");
lcd.setCursor(0, 1);  lcd.print(" Scan Your Tag ");

// Look for new cards
if ( ! mfrc522.PICC_IsNewCardPresent()) {
return;
}

  // Select one of the cards
if ( ! mfrc522.PICC_ReadCardSerial()) {
return;
} 
//Reading from the card
String tag = "";
for (byte j = 0; j < mfrc522.uid.size; j++)
{
tag.concat(String(mfrc522.uid.uidByte[j] < 0x10 ? " 0" : " "));
tag.concat(String(mfrc522.uid.uidByte[j], HEX));
```

```
}
tag.toUpperCase();  112.
//Checking the card
if (tag.substring(1) == tagUID)
{
// If UID of tag is matched.  117. lcd.clear();
lcd.print("Tag Matched");
digitalWrite(greenLed, HIGH);
delay(3000);
digitalWrite(greenLed, LOW);  122.
lcd.clear();
lcd.print("Enter Password:");
lcd.setCursor(0, 1);
RFIDMode = false; // Make RFID mode false
} 128.
else
{
// If UID of tag is not matched.
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Wrong Tag Shown");
lcd.setCursor(0, 1);
lcd.print("Access Denied");
digitalWrite(buzzerPin, HIGH);
digitalWrite(redLed, HIGH);
send_message("Someone Tried with the wrong tag \nType 'close' to halt the system.");
delay(3000);
digitalWrite(buzzerPin, LOW);
digitalWrite(redLed, LOW);
lcd.clear();
}
} 146.
// If RFID mode is false, it will look for keys from keypad
if (RFIDMode == false) {
key_pressed = keypad_key.getKey(); // Storing keys
if (key_pressed)
{
password[i++] = key_pressed; // Storing in password variable
lcd.print("*");
}
if (i == 4) // If 4 keys are completed
{
delay(200);
if (!(strncmp(password, initial_password, 4))) // If password is matched
{
lcd.clear();
lcd.print("Pass Accepted");
sg90.write(90); // Door Opened
```

```
digitalWrite(greenLed, HIGH);
send_message("Door Opened \nIf it was't you, type 'close' to halt the system.");
delay(3000);
digitalWrite(greenLed, LOW);  sg90.write(0); // Door Closed
lcd.clear();
i = 0;
RFIDMode = true; // Make RFID mode true
}
else // If password is not matched
{
lcd.clear();
lcd.print("Wrong Password");
digitalWrite(buzzerPin, HIGH);
digitalWrite(redLed, HIGH);
send_message("Someone Tried with the wrong Password \nType 'close' to halt the system.");
delay(3000);
digitalWrite(buzzerPin, LOW);
digitalWrite(redLed, LOW);
lcd.clear();
i = 0;
RFIDMode = true; // Make RFID mode true
}
}
}
}
} 190.
// Receiving the message
void receive_message()
{
char incoming_char = 0; //Variable to save incoming SMS characters
String incomingData; // for storing incoming serial data

if (SIM900.available() > 0)
{
incomingData = SIM900.readString(); // Get the incoming data.
delay(10);
} 202.
// if received command is to open the door
if (incomingData.indexOf("open") >= 0)
{
sg90.write(90);
NormalMode = true;
send_message("Opened");
```

```
209. delay(10000);  210.  sg90.write(0);  211. } 212.
```

```
213. // if received command is to halt the system
214. if (incomingData.indexOf("close") >= 0)
215. {
216. NormalMode = false;
217. send_message("Closed");
218. }
219. incomingData = "";
220. }
221.
222. // Function to send the message
223. void send_message(String message)
224. {
225. SIM900.println("AT+CMGF=1"); //Set the GSM Module in Text Mode
226. delay(100);
227. SIM900.println("AT+CMGS=\"+919564151906\""); //
228. delay(100);
229. SIM900.println(message); // The SMS text you want to send
230. delay(100);
231. SIM900.println((char)26); // ASCII code of CTRL+Z
232. delay(100);
233. SIM900.println();
234. delay(1000);
235. }
```